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REDISCOVERY OF *TULOTOMA MAGNIFICA* (CONRAD) (GASTROPODA: VIVIPARIDAE)

Robert Hershler, J. Malcolm Pierson, and R. Stephen Krotzer

Abstract.—Recent reports have concluded that the monotypic viviparid snail genus *Tulotoma* Haldeman, 1840, once relatively widespread in lotic waters of the Coosa-Alabama River System, is extinct or reduced to one or two small colonies at most. The authors conducted an extensive survey for the snail during 1988–1989 and discovered five populations in shoal habitat of the Coosa River and its larger tributaries. These populations are separated by unsuitable snail habitat consisting of reaches of impounded river and probably are not in genetic contact with one another.

The genus *Tulotoma* (type species, *Paludina magnifica* Conrad, 1834) is one of many aquatic mollusks endemic to the Coosa-Alabama River System. *Tulotoma magnifica* (commonly known as the tulotoma) is a particularly impressive snail, with a large (>25 mm tall) shell usually ornamented with prominent, spirally arranged knobs (Fig. 1). The genus was erected by Haldeman in 1840 and includes four species described (as *Paludina*) between 1834–1841. While early workers usually recognized at least two of these species (see Wetherby 1877), most recent authors (e.g., Clench 1962, Burch 1982) considered the genus to be monotypic. Note, however, that Patterson (1965) documented differences in chromosome numbers between two tulotoma populations and suggested that several species may be involved.

The historic distribution of the tulotoma, based on examination of various museum collections, is shown in Fig. 2. In the Coosa River System of Alabama, the snail ranged widely from Big Canoe Creek south to Wetumpka, just above the confluence with the Tallapoosa River. Localities included numerous sites on the Coosa River as well as lower reaches of several large tributaries. The snail has been recorded from only two localities in the Alabama River System: the main river in the vicinity of Claiborne (type locality for *T. magnifica*), and Chilatchee Creek southwest of Selma. Records from waters apart from the above are doubtful, in some cases because the material was from Indian middens and probably was transported from original localities (e.g., Black Warrior River records; Clench 1962), and in other cases because the localities are well separated from the general range of the snail and have not been verified by later collecting (e.g., Bridgeport, Jackson Co.; Patsaliga Creek, Crenshaw Co.).

The biology of the tulotoma is virtually unknown, apart from the fact that it broods young and filter-feeds (as do other members of the Viviparidae). Early descriptions indicated that the tulotoma inhabited riffles and shoals, clinging tightly to the undersides of large rocks. Local abundance was common: Hinkley (1904:43) noted that in the Coosa River, "They were generally in colonies; it was not uncommon to find 20 or 30 under a single stone a foot square or more."

Modifications of the Coosa-Alabama River System have been extensive since the description of the tulotoma in 1834. Six major dams were completed along the Coosa River in Alabama between 1914 and 1966, resulting in impoundment of much of the river and lower portions of tributaries. Pol-

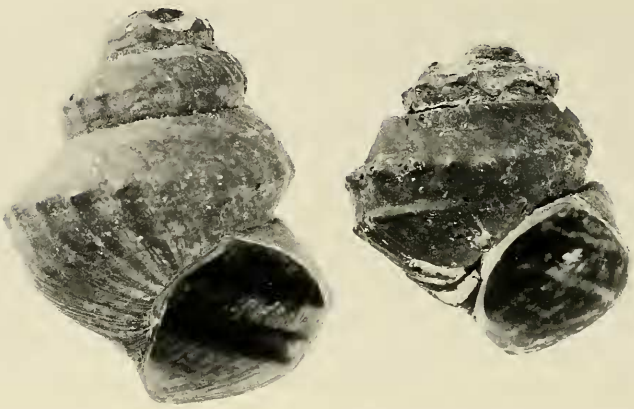

Fig. 1. Shells of *Tulotoma magnifica* (Conrad): to left, USNM 858098, Kelley Creek, St. Clair County, Alabama (27.2 mm tall); to right, USNM 858097, Coosa River above Wetumpka, Elmore County, Alabama (22.2 mm).

lution of this drainage also has been on the increase, due to introduction of waste waters of various municipalities (Hurd 1974). Dredging of the Alabama River channel began in 1878 and continues to the present day. Locks and dams on that river were completed in the 1960s.

Decline of the tulotoma has been evident for at least 50 years. The snail no longer could be found at Claiborne by the mid-1930s (Goodrich 1944, Clench 1962), nor has it been found elsewhere in Alabama River drainage in the past 50 years. Reduction of numbers (of all prosobranch snails) in the Coosa River was obvious by 1944, as summarized by Goodrich (1944:1–2):

> "For the waters have been backed up behind great dams, miles of reefs are covered and formerly quiet reaches between rapids have been expanded into silt-accumulating lakes. At the foot of the lowermost dam are remains of the old Wetumpka rapids, but I have been told that ten to fifteen feet of water [actually 1–2 m depending on number of turbines operating; Pierson, personal observation] rush over them in the hours that the dynamos are operating. Moreover, upstream sections which once ran clear, Rome to Cedar Bluff, for example, are turbid with field wash, even in a dry August, and one gets specimens, if any, by feeling for them."

The last live collections of the tulotoma were those of Herbert Athearn (*in* Stein 1976), who located three populations in upper Coosa River drainage between 1955–1963 (before completion of Logan Martin Dam), and U.S. Army Corps of Engineers (1981), which found a single live individual in Lay Reservoir below Kelley Creek. Recent reports concluded that the snail is now either extinct or consists of only one or two remaining colonies (Heard 1970, Davis 1974, Stein 1976). The snail currently is a candidate for possible addition to the List

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Fig. 2. Historic distribution of *Tulotoma magnifica*. Map modified from United States Geological Survey 1:500,000 State of Alabama sheet (1970 edition). Filled circles indicate a single or two or more closely spaced localities.

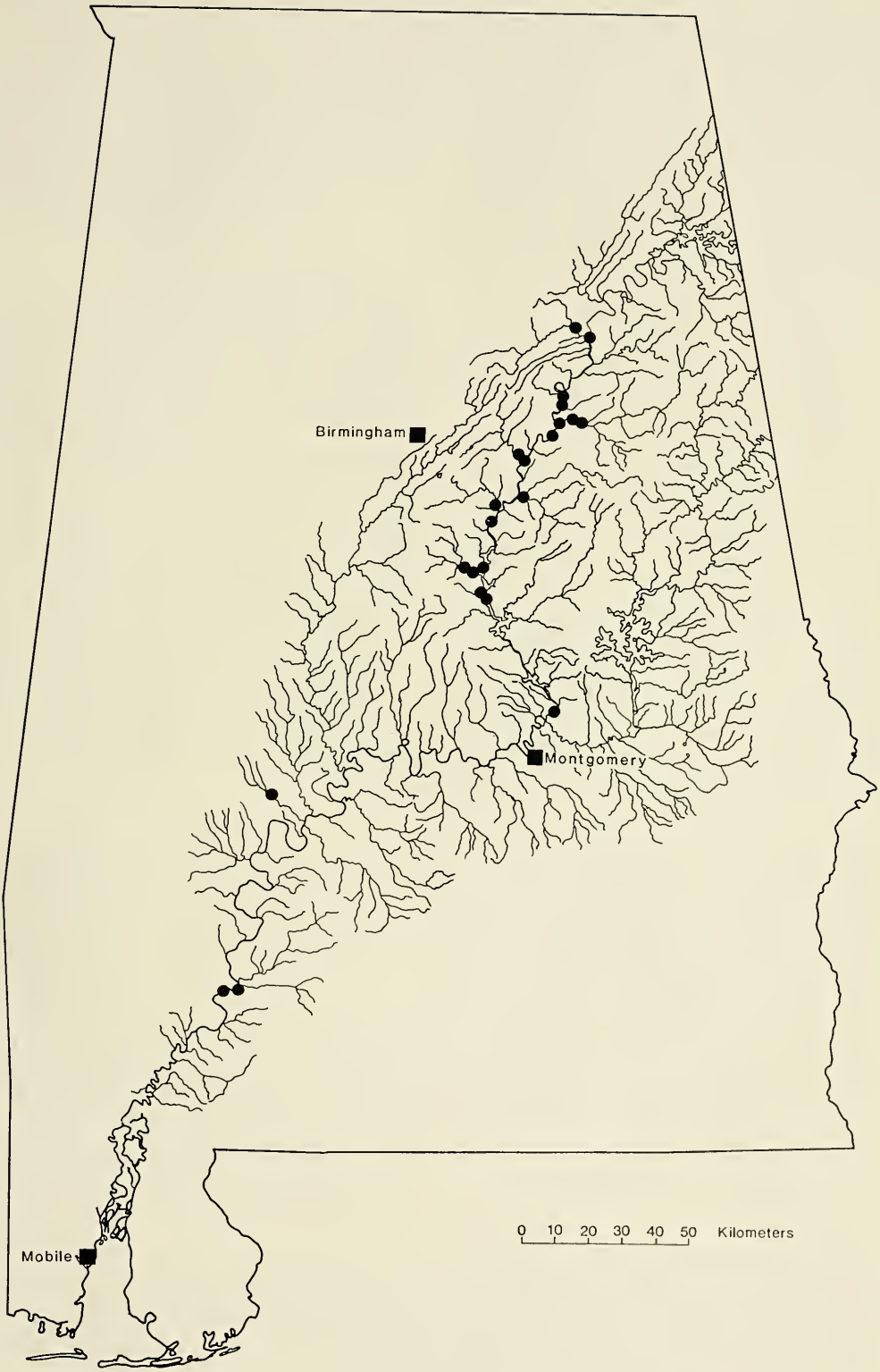
Birmingham
Montgomery
Mobile
0 10 20 30 40 50 Kilometers

Fig. 3. Localities surveyed (descriptions in Appendix).

of Endangered and Threatened Wildlife (USDI 1989).

During 1988–1989 the authors conducted a field survey for the tulotoma, principally in the Coosa basin, and discovered several live populations, which are reported below. A redescription of this remarkable snail will be published elsewhere.

Methods

Sites visited included those where the tulotoma had been found previously as well as other locales within the historic range of the species. Large tributary creeks and rivers were visited, usually at road crossings. In a number of instances, sites were considered unsuitable for the snail based on scrutiny from bridges and search was not conducted. At potentially suitable sites (e.g., ones in which riffles were present), search was conducted by two or three people, who examined surfaces (particularly undersides) of rocks for time periods of 15 minutes to 3 hours. Boats occasionally were used to reach sampling sites and diving was necessary to gather and/or examine stones from deep water.

Results

Seventy-eight sites (Appendix 1, Fig. 3) were visited, of which fifty-four were intensively searched. The tulotoma was found living in five areas (Fig. 4), which are described below:

1) Ohatchee Creek, Calhoun County: Snails were found in a small shoal several kilometers upstream from the creek's mouth. Substrate consisted of slabs, ledges, and sharp, angular boulders. Snails were rare (six individuals collected) on medium-sized boulders in moderate current. The species was not found at two sites upstream from the above.

2) Kelley Creek, St. Clair County: Snails were collected at various points along a two km section of the moderate-sized stream (generally <1.5 m deep and 8 m wide) beginning at the boat landing about a hundred meters above the mouth (and upstream to SW ¼ sec. 29, T 18S, R 3E). The creek bottom was muddy, and stones were uncommon except in riffles. Snails were found throughout this area but were particularly common in a long riffle zone above the first bridge crossing (border of secs. 29, 32), where up to 20–30 snails were found on single large stones. The stream was subject to a rapid rise in water level when Logan Martin Dam was generating, during which time snails had to be collected by diving for stones. Snails were not found in the Coosa River at or near the mouth of the creek (but note the 1981 Corps of Engineers record cited above).

3) Weogufka Creek, Coosa County: Snails were found commonly in the first set of shoals (rocky bottom, no silt) above Mitchell Reservoir.[1] The tulotoma was much less abundant at two sites 3–4 km above the mouth of creek where fewer than 20 individuals were found after almost 2 hours of searching. At the latter sites the stream was fairly small (3–5 m across, <1 m deep) and predominantly riffle, with the bottom densely littered with small rounded stones covered with green algae. Snails were absent at one site upstream from the above.

4) Hatchet Creek, Coosa County: Snails were found commonly (50–60 individuals on a single large rock) in fast shoals at the lower end of the creek E-NE of Kelly's Crossroads.[1] Snails also were found in the creek ca. 3 km upstream from the confluence with Swamp Creek (ca. 6 km upstream from Mitchell Lake). At this site the creek was about 7 m across and had both short riffles and large pooled areas. Snails were rare: only 6 individuals were collected in 30 minutes. Snails were absent at a site upstream from the above.

[1] R. G. Bowker, United States Fish and Wildlife Service (Jackson Field Office) reported finding the tulotoma at the beginning of reservoir influence on both Weogufka and Hatchet Creeks in October, 1989 (letter to RH, 10-23-89).

Fig. 4. Current distribution of *Tulotoma magnifica*.

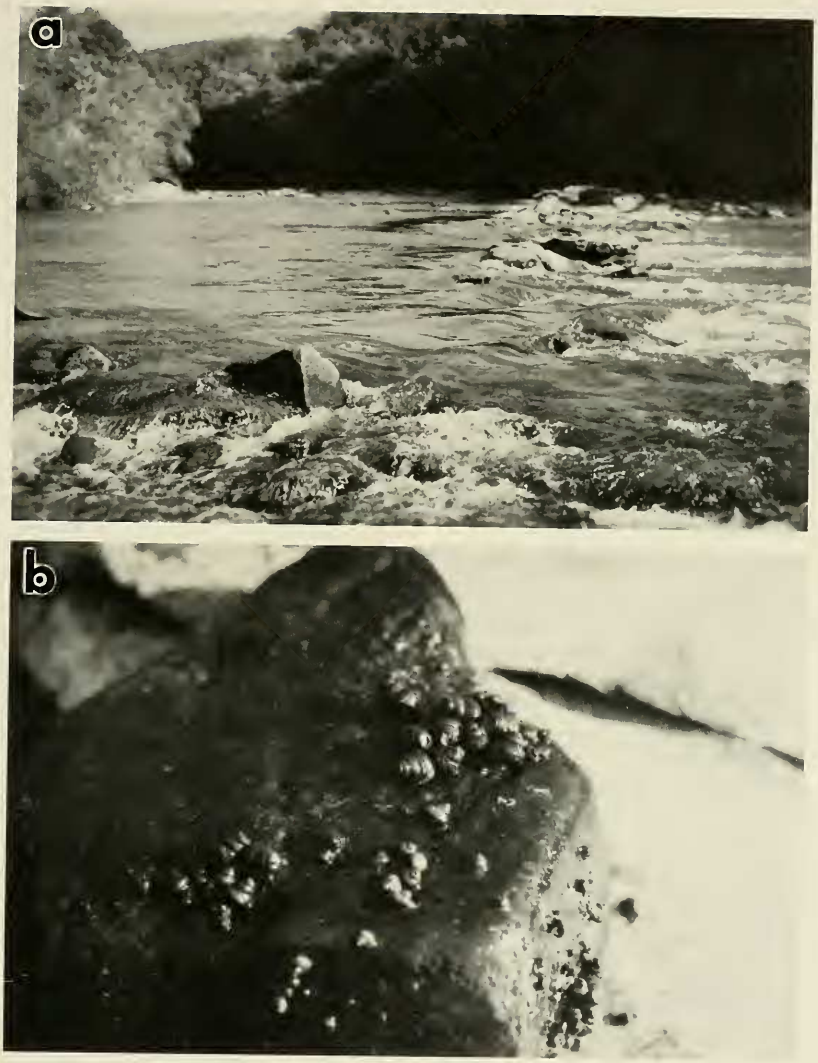

Fig. 5. Photographs of tulotoma site on Hatchet Creek, Coosa County, Alabama: a, snail-bearing shoals; b, underside of large stone showing clustered snails.

5) Coosa River, between Jordan Dam and Wetumpka, Elmore County: The river is free-flowing for at least the upper portion of this area and contains a series of impressive shoals. Snails were collected from two such areas separated by 2–3 km. In both sites the river was constricted by a complex of small islands through which the water rushes. The bottom was gravel-sand and was littered with stones of various sizes. Snails were very common on rocks in narrow riffle areas (up to 40–50 specimens/large stone) and less numerous in pooled areas. During normal daily generation from one turbine (4400 cfs for 2.25 hours) the water level would rise a maximum of 1 m at Moccasin Shoal. Maximum turbine discharge at full gate (21,000 cfs) would raise the river level about 2 m at this location (a very rare event). Snails were absent both from a shoal about

1 km upstream from the above, and downstream at Wetumpka.

Associated molluscan fauna at the above sites included diverse pleurocerid snails and unionid clams, and *Corbicula.*

Discussion

A synthesis of results of this survey and available literature allows a general interpretation of the habitat requirements of the tulotoma. The snail is restricted to cool, well-oxygenated, clean water in free-flowing river and lower portions (ca. lowermost 4–5 km) of large tributary streams (Fig. 5a). The tulotoma never has been recorded from upper reaches of tributaries: perhaps such habitat is unsuitable owing to its small size and/or adverse physiochemical conditions (e.g., softer water compared to downstream). The animal clings to undersides of submerged large stones (which usually rest on hard bottoms), with individuals densely clustered rather than uniformly distributed (Fig. 5b). Densities are highest in riffles or shoals, although snails also occur in pooled areas. Although the tulotoma can tolerate diurnal variation in hydrologic variables (as seen in the Kelley Creek population), continued persistence of the snail in waters where such variation is extreme (as in the river immediately below a dam) appears unlikely.

Perusal of the historic and current distribution maps indicates that a drastic reduction of the tulotoma's range has occurred over the past 150 years (compare Figs. 2 and 4). The snail now is apparently extinct in the Alabama River system and restricted to several km of free-flowing Coosa River below Jordan Dam and short sections of four large creeks tributary to the river. These populations are isolated by reaches of unsuitable tulotoma habitat (impounded river) that are quite long, with the exception of Weogufka and Hatchet Creeks (which discharge into Mitchell Lake at points separated only by a few km), and probably are not in genetic contact with one another. The largest population appears to be that of the Coosa River below Jordan Dam where some tens of thousands of individuals occur. Much of the range reduction can be attributed to unequivocal habitat destruction associated with impoundment of a large portion of the Coosa River in Alabama.

Acknowledgments

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(RH) Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560; (JMP, RSK) G.S.C. #8, Alabama Power Company, Post Office Box 2641, Birmingham, Alabama 35291.

Appendix

Localities surveyed. Data include topographic coordinates and date of visitation. Positive localities are indicated by an asterisk.

ALABAMA. Autauga County: Shoal Creek, State HW 143 (crossing), T 20N, R 16E, SW ¼ sec. 27, 6-2-88.

Calhoun County: Coosa River below Neely Henry Dam, 3.2 km SW of Ohatchee, T 14S, R 6E, SE ¼ sec. 31, 10-11-88.—Ohatchee Creek: N of State HW 62, T 14S, R 6E, SW ¼ sec. 27, 9-20-89; State HW 62, T 14S, R 6E, SW ¼ sec. 27, 6-6-88; *1.9 km S of Ohatchee, T 14S, R 6E, SE ¼ sec. 33, 10-11-88.—Cane Creek: State HW 77, T 15S, R 6E, SW ¼ sec. 18, 9-20-89; County Road 73, T 15S, R 5E, SW ¼ sec. 13, 9-20-89.

Cherokee County: Little River: State HW 35, T 7S R 10E, SE ¼ sec. 30, 6-4-88; State HW 273, 8.8 km NW of Cedar Bluff, T 9S, R 9E, NE ¼ sec. 3, 10-13-88.—Terrapin Creek: 0.6 km S of Ellisville, T 11S, R 9E, SW ¼ sec. 20, 10-13-88; NW of Providence Church, T 11S, R 9E, SE ¼ sec. 34, 9-20-89.

Chilton County: Coosa River, Lay Dam tailrace, T 23N, R 15E, NW ¼ sec. 24, 10-11-88.—Yellowleaf Creek: Crossing S of Page Creek confluence, T 23N, R 15E, SW ¼ sec. 22, 9-13-88; Crossing N of Lime Springs Church, T 23N, R 15E, NE ¼ sec. 20, 9-13-88; 1.6 km SW of Lay Dam, T 23N, R 15E, SW ¼ sec. 25, 10-5-88.—Walnut Creek: County Road 32, T 22N, R 15E, SE ¼ sec. 14, 9-18-89; 10.9 km E-NE of Clanton, T 22N, R 16E, NE ¼ sec. 19, 10-5-88.—Chestnut Creek: State HW 3 at Verbena, T 21N, R 15E, SE ¼ sec. 36, 6-2-88; 8.0 km E-NE of Verbena, T 21N, R 16E, NE ¼ sec. 35, 10-6-88.

Coosa County: Paint Creek, 3.2 km S-SE of Marble Valley, T 24N, R 16E, SE ¼ sec. 35, 10-11-88.—Weogufka Creek: NW of Moriah, T 23N, R 17E, NE ¼ sec. 34, 6-3-88, 10-3-88; *Horse Stomp Campground, T 22N, R 17E, SE ¼ sec. 6, 9-18-89; *Crossing SW of above, T 22N, R 17E, NW ¼ sec. 7, 9-18-89; *First shoals above Mitchell Reservoir, T 22N, R 16E, SE ¼ sec. 13, 10-6-88.—Hatchet Creek, 9-18-89: US 231, T 23N, R 19E, SE ¼ sec. 30, 9-18-89; *SE of Lyle, T 22N R 18E, NW ¼ sec. 19, 9-18-89; *3.7 km N-NE of Kelly's Crossroads, T 22N, R 17E, NW ¼ sec. 25, 10-7-88.—Swamp Creek: State HW 22, T 22N, R 18E, SE ¼ sec. 30, 9-18-89; County Road 29, 2.4 km N of Kelly's Crossroads, T 22N, R 17E, SW ¼ sec. 25, 10-27-88.

Dallas County: Soapstone Creek, US 80, T 16N, R 12E, NW ¼ sec. 31, 6-3-88.—Cedar Creek, State HW 41, T 14N, R 10E, NE ¼ sec. 14, 6-3-88.—Oak Creek, State HW 41, T 13N, R 10E, SW ¼ sec. 8, 6-3-88.

Elmore County: Coosa River: Just below Jordan Dam, T 19N, R 18E, NE ¼ sec. 22, 6-2-88; Shoal ca. 1 km below dam, T 19N, R 18E, SE ¼ sec. 22, 9-14-88; *Moccasin Shoal, ca. 5 km upstream from Wetumpka, T 18N, R 18E, NE ¼ sec. 2, 9-18-89; *Ca. 2.5 km upstream from Wetumpka, T 18N, R 19E, NE ¼ sec. 7, 9-14-88; Vicinity of Wetumpka boat ramp, T 18N, R 19E, NE ¼ sec. 24, 9-14-88.

Monroe County: Tallahatchee Creek, State HW 41, T 10N, R 7E, NE ¼ sec. 20, 6-3-88.—Beaver Creek, State HW 41, T 9N, R 6E, NE ¼ sec. 24, 6-3-88.—Big Flat Creek, State HW 41, T 7N, R 6E, NE ¼ sec. 1, 6-3-88.—Alabama River, 9-14-88: Base of limestone bluff on west side of river, ca. 3.0 km below Claiborne Lock and Dam, T 7N, R 5E, SE ¼ sec. 11; ca. 1.6 km below Claiborne-Murphy Bridge, T 7N, R 5E, NE ¼ sec. 26.—Limestone Creek: State HW 41, T 7N, R 7E, NE ¼ sec. 22, 6-3-88; from mouth to ca. 0.5 km upstream, T 7N, R 6E, SE ¼ sec. 19, 9-14-88.

St. Clair County: Big Canoe Creek, US 231, T 14S, R 4E, SE ¼ sec. 6, 6-4-88.—Beaver Creek, US 231, T 14S, R 3E, NE ¼ sec. 36, 6-4-88.—Shoal Creek, US 231, T 15S, R 3E, SE ¼ sec. 1, 6-4-88.—Coosa River, ca. 0.8 km below Logan Martin Dam, T 18S, R 3E, SW ¼ sec. 33, 9-12-88.—Kelley Creek: *E-NE of Logan Martin Dam substation (upstream from crossing), T 18S, R 3E, SW ¼ sec. 29, 9-21-88, 9-13-89; *Kelley Creek Landing, T 19S, R 3E, NE ¼ sec. 6, 9-12-89; Mouth, T 19S, R 3E, NW ¼ sec. 5, 9-12-89.

Shelby County: Stream tributary to Kelley Creek, W-SW of Macedonia Church, T 18S, R 2E, SE ¼ sec.

23, 6-1-88.—Spring Creek N of Vincent, T 19S, R 2E, SW ¼ sec. 11, 6-1-88.—Morgan Creek NW of Klein, T 20S, R 2E, SE ¼ sec. 17, 6-1-88.—Yellowleaf Creek: State HW 25, T 20S, R 2E, SE ¼ sec. 29, 6-1-88; 6.1 km S-SW of Harpersville, T 20S, R 2E, NE ¼ sec. 18, 10-4-88.—Fourmile Creek, County Road 441, T 20S, R 2E, SE ¼ sec. 30, 6-1-88.—Waxahatchee Creek: 4.8 km S-SW of Shelby, T 24N, R 15E, SE ¼ sec. 7, 10-11-88; State HW 145 S of Shelby, T 24N, R 15E, SE ¼ sec. 20, 6-1-88.

Talladega County: Blue Eye Creek, State HW 77, T 16S, R 5E, SW ¼ sec. 22, 6-6-88.—Eastaboga Creek, in Old Eastaboga, T 16S, R 6E, SW ¼ sec. 33, 6-6-88.—Choccolocco Creek: County Road 399, T 17S, R 6E, NW ¼ sec. 15, 9-19-89; 2.9 km S of Old Eastaboga (near Brick Store Church), T 17S, R 6E, SW ¼ sec. 9, 10-27-88; County Road 5, T 17S, R 6E, SW ¼ sec. 17, 9-19-89; Lower end of Jackson Shoals, T 17S, R 5E, SW ¼ sec. 14, 6-1,4-88, 9-21-88.—Cheaha Creek, County Road 5, T 17S, R 6E, SW ¼ sec. 20, 10-27-88, 9-19-89.—Coosa River, east bank below Logan Martin Dam, T 18S, R 3E, NW ¼ sec. 33, 9-28-88.—Talladega Creek: 5.6 km N-NE of Childersburg, T 20S, R 3E, NE ¼ sec. 3, 9-28-88; At Kymulga, T 19S, R 3E, center of sec. 35, 9-19-89.—Tallasseehatchee Creek: County Road 105, T 20S, R 4E, SE ¼ sec. 30, 9-19-89; N-NW of Friendship Church, T 20S, R 3E, SE ¼ sec. 14, 9-19-89; 3.8 km E-NE of Childersburg, T 20S, R 3E, sec. 22, 9-28-88.—Kahatchee Creek, 6.6 km SW of Childersburg, T 21S, R 2E, NW ¼ sec. 2, 10-4-88.

Tallapoosa County: Tallapoosa River, 10.7 km S-SW of Daviston, T 23N, R 24E, SE ¼ sec. 19, 9-27-88.

Wilcox County: Pine Barren Creek, State HW 41, T 13N, R 9E, SW ¼ sec. 28, 6-3-88.—Pursley Creek, State HW 41, T 11N, R 7E, NE ¼ sec. 2, 6-3-88.—Gravel Creek, State HW 41, T 11N, R 7E, NW ¼ sec. 22, 6-3-88.—Chilatchee Creek, Alberta, T 15N, R 7E, SE ¼ sec. 30, 9-15-88.